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The Genus Frankia in the United States.

By Geo. F. Atkinson.

(Plate CXXVIII).

At the Indianapolis meeting of the A. A. A. S. in 1890, Dr. W. J. Beal exhibited before the Botanical Club specimens of root-galls on *Ceanothus Americanus*.* Knowing of my interest in the subject of root-galls he left the specimens with me for determination. The galls resembled so closely in external appearance those of the tubercles of some of the Leguminosæ that I half suspected they were caused by a similar organism. On examining a section, however, it was at once apparent that the analogy was entirely superficial. In the parenchymatous tissue surrounding the central cylinder were numerous enlarged cells occupied by what appeared to be plasmodia, bearing a striking resemblance to those of *Plasmodiophora Brassicæ*, Wor.†

Fearing that the real nature of the organism might be disguised by the influence of the alcohol in which the specimens were preserved, I sent to Dr. Beal for fresh material. From this material the true condition of affairs was at once presented. The organism is closely allied to that producing the galls on the roots of various species of *Alnus* and the Elæagnaceæ, which has been long known in Europe, and was first described by Woronin as *Schinzia Alni*.‡ This fact, and also that the fungus has more

* Botanical Gazette, Vol. XV., No. 9, p. 232.

† Pringsheim's Jahrbücher, Bd. XI., 1877.

‡ Ueber die bei der Schwarzerle und der gewöhnlichen Garten-Lupine auftretenden Wurzelanschwellungen, Memoires d. l'Acad. Imp. d. Sciences, VIIe Series, Tome X., No. 6, p. 2, 1866.

recently served as the basis of Brunchorst's new genus *Frankia*,* I reported to the Botanical Club at the Washington meeting of the A. A. A. S., 1891.†

During the month of December following I took occasion on one of my collecting trips to examine the roots of *Alnus serrulata*, believing for more than a year that quite likely the fungus was as common here as in Europe. This I found to be the case, and I have since collected some very fine specimens. The next step was to examine the roots of *Ceanothus Americanus* in this vicinity, and sure enough the galls are common to Alabama as well as to Michigan, and I have no doubt that a rich harvest has for years been awaiting the root-gall fungus hunter in all parts of America.

On *Ceanothus Americanus* the galls when young are flesh colored, cylindrical, and from 1-2 mm. in diameter, by 2-6 mm. in length. They originate as minute lateral abnormal growths from young roots, or in many cases from the side of the large tap root. In successive years they continue their growth by a dichotomous or trichotomous branching, each year's growth remaining from 1-2 mm. in diameter and 4-6 mm. in length. After several years there is developed a loosely branched dendroid body. The older portions of the gall become dark or nearly black in color, while the new year's growth is flesh color.

The galls on *Alnus serrulata* differ in form as a whole, while the manner of growth is quite similar. The individual yearly growth is more restricted, so that a rotund or irregularly oval more or less compact mass with a botryose appearance is developed. The gall of the first year is 2-3 mm. long by 1-2 mm. in diameter. By successive di- or tri-chotomies the mass is formed from the size of a pea to that of a small walnut. In some species of *Alnus* the gall reaches the size of one's fist.‡ In the larger galls on the *Alnus* the original dichotomous branching is lost sight

* Ueber einige Wurzelanschwellungen, besonders diejenigen von *Alnus* und den Elæagnaceen, Unters. Bot. Inst. Tübingen, Zweiter Band, p. 151, u. folg.

† Botanical Gazette, Vol. XVI., No. 9, p. 262.

‡ Woronin, Mem. de l'Acad. Imp. des Sciences; Sorauer, Pflanzenkrankheiten, Zweite Auflage, Erster Band, p. 747. Brunchorst, Unters. Bot. Inst. Tübingen; Frank, Krankheiten der Pflanzen, and others.

of in the compact growth, and is only plainly visible in the surface.

The internal structure of the gall differs but little in the relation of the different tissue systems from that of the normal root. The central cylinder is present surrounded by an abnormally great development of parenchymatous tissue, which is surrounded by the corky layer. The parenchymatous tissue harbors the parasite.

In *Ceanothus Americanus* there is a narrow zone of parenchymatous cells, immediately surrounding the central cylinder, usually free from the parasite and made up of nearly isodiametric cells. Bordering this is a broad zone of parenchymatous tissue of large cells quite variable in size and shape. The cells containing the parasite are usually considerably larger than the others. Frequently all the cells of this zone viewed in cross section are elongated radially. In *Alnus serrulata* the cells containing the fungus are but little if any larger than the other parenchymatous cells, and the radial elongation of the cells is rarely observed. The observation and determination of the fungus is not so easy as in the galls on *Ceanothus Americanus*, because of other substances which obscure it.

The fungus when mature forms compact botryoid clusters in the affected parenchymatous cells of the gall, the central portion being composed of a complexly-branched mass of threads bearing at their ends on the periphery of the mass the globose sporangia.

A brief résumé of the leading views concerning these galls from a historical standpoint will be of interest in connection with a description of the fungus.

Meyen* considered them to be parasites growing upon the roots of *Alnus*, having a habit in this respect similar to members of the Balanophoraceæ or Orobanchaceæ, though lower in development and systematic position.

Schacht† at first regarded them as normal growths of the roots. Later‡ he held the view that they were abnormal growths, but offered no theory as to their cause.

* Ueber das Hervorwachsen parasitischer Gewächse, etc., Flora, 1829, S. 49. Quoted from Woronin, Mem. d. l'Acad. Imp. d. Sciences VIIe, Tome X., No. 6, p. 2.

† Flora, 1853, S. 10, 11. Quoted from Wor. l. c.

‡ Der Baum, 1860, S. 172-174. Quoted from Wor.

Jäger * thought they were of insect origin.

Woronin † considered the fungus to be closely related to Nägeli's genus *Schinzia*. This genus was founded upon a fungus which pierced the root rind of various species of *Iris*, and produced flask-shaped bodies at the ends of the threads in the cells‡.

Magnus considered it too different from *Schinzia cellulicola* to be placed in the same genus.§

An article by A. Gravis ‖ entitled, "Observatione anatomiques sur les excroissances des racines de l'aune" induced Woronin to make additional researches upon young galls of *Alnus*. The condition of the organism he found here bore such a resemblance to his *Plasmodiophora Brassicæ* * that he communicated to Gravis his belief that two organisms were frequently present, one a *Plasmodiophora* like Myxomycete, and the other a filamentous fungus. Gravis communicated this in "Note sur les excroissances des racines de l'aune.†"

E. Warming ‡ notes the presence of galls on *Hippophoe*, *Elæagnus* and *Shepherdia* which resemble those on *Alnus*, and records the discovery of what he considers a parasitic Myxomycete of like nature with Woronin's *Plasmodiophora*.

H. Möller§ in his earlier studies of these galls used only alcoholic material, and probably for this reason overlooked the real nature of the fungus. He claimed to have demonstrated

* Ueber eine krankhafte Veränderung der Blüthen Organe der Weintraube, Flora, 1860, S. 49. Quoted from Woronin.

† Mem. d. l'Acad. Imp. d. Sciences, VIIe, Tome X., No. 6, 1866, St. Petersburg.

‡ Flora, 1842, p. 278. See Sorauer, Pflanzenkrankheiten, Bd. I., p. 748.

§ Sitzungsberichte des bot. Ver. d. Prov. Brandenburg XXI., June 27, 1879. Quoted in Sorauer, Pflanzenkrankheiten, Bd. I., p. 748.

‖ Bulletin de la Société royale de Botanique de Belgique, Tome XVIII., 1re partie, p. 50-60. See Berichte der Deutschen Botanischen Gesellschaft, Bd. III., 1885, p. 177.

* Pringsheim's Jahrbücher Bd. XI., 1877.

† Compte rendu de la séance mensuelle du Jan. 10, 1880, de la Société royale de botanique Belgique. See Berichte der Deutschen Botanischen Gesellschaft Bd. III. 1885, p. 177.

‡ Smaa biologiske ogmorfologïske Bidrag. Botanisk Tidsskrift, 3dei Räkke, Bd. I,, 1876, p. 84. Reference "Wurzelknöllchen bei den Elæagneen, Just's Jahresbericht, 1876, p. 439.

§ *Plasmodiophora Alni*, Berichte der Deutschen Botanischen Gessellschaft, Bd. III, 1885, p, 102-105.

its affinity with *Plasmodiophora* and named it *Plasmodiophora Alni*. Woronin * then reviews Möller's article and states that it yet remains to be shown whether this *Plasmodiophora*-like parasite is the sole cause of the root galls, or whether, perhaps, as he already had suggested † it was accompanied by a filamentous fungus.

Brunchorst,‡ by his excellent investigations, gets the key to the true nature of the parasite and thus fairly sets in order a subject hitherto clouded in great confusion. The fungus is shown to be a filamentous one and what Woronin § and Möller‖ took to be spores are in reality sporangia, which by successive oblique divisions of the protoplasmic contents form spores.

The plasmodia of various authors is the cell plasma of the host with the very fine fungus threads imbedded in it and so obscured that they cannot be seen except by the use of certain reagents. Thus with the use of a hot solution of "Salzsäure" in galls from *Alnus glutinosa*, a delicate filamentous structure, reminding one of a skein of matted threads, is made visible.

In longitudinal sections of a gall, he calls attention to three rather ill-defined zones, representing different stages of development of the parasite. Just behind the root-cap is the first zone, bearing the younger stages of the fungus, where in fresh untreated preparations it resembles plasmodia. Next comes the sporangium zone, where the hyphæ can be seen quite well, bearing on their ends at the outer surface of the hypha-skein the sporangia. In the third zone the contents of the sporangia are either undergoing division into spores, or are empty.

The likeness of the fungus in the younger zone to plasmodia

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* Berichte der Deutschen Botanischen Gesellschaft, Bd. III., 1885, p. 177, 178.

† Compte rendu de la séance mensuelle du 10 Jan., 1880, de la Société royale de botanique Belgique. See also Revue Mycologique, Tome II., 1880, p. 69, 70, and Bot. Centralblatt, 1880, p. 354.

‡ Ueber die Knollchen an den Wurzeln von Alnus und den Elæagnaceen. Bot. Centralblatt, xxiv. p. 222, 1885.

Ueber einige Wurzelanschwellungen, besonders diejenigen von Alnus und den Elæagnaceen. Unters. Bot. Inst. Tübingen, Zweite Band, p. 151, 1886. See also Bot. Centralb. Bd. xxviii, p. 109, 1886.

§ Mem. Acad. Imp. Sci., etc.

‖ Bericht., Deut., Bot. Gess.

is heightened by the fact that the threads which emerge from the mass and pass through the cell walls to other cells, give the appearance of very delicate pseudopodia.

Ward * says that the fungus of the tubercles of the roots of Leguminous plants stimulates the protoplasm of the tubercles, so that it resembles plasmodia. It is possible that some such influence is exerted on the protoplasm of the galls of *Alnus*, etc.

Woronin,† Frank,‡ Sorauer § represented several sporangia on a single thread. Brunchorst (l. c.) shows that this appearance is an optical illusion, sporangia frequently lying over threads appear as if united with them.

Möller‖ observed the hyphæ in the sporangium zone, but regarded them as remnants of the plasmodium, which did not go to form spores and which remained in connection with the spores as they were differentiated from the mass. Brunchorst calls attention to the fact that if this were so they would not be so constant in outline and diameter.

Brunchrost properly regards the fungus as distinct from *Schinzia*, and takes it as the type of a new genus which he calls *Frankia*. Unfortunately he does not accept the well-known specific name *Alni*, but calls it *Frankia subtilis*. While there are variations in the size of the sporangia from different hosts, he does not consider them sufficient to be of specific value.

Thus in *Alnus undulata* they vary from 4μ-6μ; in *Hippophoë rhamnoides* from 2μ-3.5μ; and in *Alnus glutinosa* from 3μ-5μ.

B. Frank * rejects the theory that they are abnormal growths due to a parasitic fungus, but regards them as normal organs for the transitory storage of proteid bodies.

Möller,† in 1890, reinvestigated the galls, using fresh material

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* Phil. Trans. Vol. 178, p. 547.

† Mem. d. l'Acad. Imp. d. Sci. VIIe. T. X. 6, 1866.

‡ Krankheiten der Pflanzen, 647.

§ Pflanzenkrankheiten, Bd. I.

‖ Ber. d. Deutsch. bot. Gesellschaft Bd. III. 1885, p. 102.

* Sind die Wurzelanschwellungen der Erlen und Elæagnaceen Pilzgallen? Ber. d. deutschen Bot. Gesellschaft, Bd. V. Heft. 2. Reference in Bot. Centralblatt, Bd. XXV. p. 366.

† Beitrag zur Kenntniss der *Frankia subtilis* Brunchrost, Ber. d. Deutsch bot. Gesellschaft Bd. VIII., 1890, p. 215-224. See Centralblatt für Bakteriologie und Parasitenkunde Bd. VIII,, 1890, p. 559-560 and Bot. Centralb. 1891, p. 60.

instead of alcoholic material, and corroborates Bunchorst's view that the organism is a filamentous fungus, but differs from him in some minor details. Brunchorst thought the hyphæ were septate, but Möller claims that they are continuous.

He also notes the much stouter mycelium and the irregular sporangia in the galls of *Myrica Gale*, and considers it a distinct species for which he proposes the name *Frankia Brunchorstii*.

It appears to me that the fungus in the galls of *Ceanothus Americanus* is a distinct species from the other forms, and I propose the name *Frankia Ceanothi* for it.

In addition to the characters given above are the following: The infected cells are 30-50x50-70μ. The sporangia are smaller than in any described species, varying from 1.5-2μ.

It is worthy of remark, probably these organisms have a very wide and complete distribution, so that the galls are probably found wherever the hosts grow. In this respect they are analogous to the organisms which produce the tubercles on the roots of the Leguminosæ. The question would then naturally arise whether there is a symbiotic relationship between parasite and host, for so far as can be seen they cause no inconvenience to their host. I am not aware that this matter has been tested. The contents of the sporangia of *Frankia*, like the "bakteroids" of the tubercles, have a proteid nature* and color yellow with Jod, red with Millon's reagent, and are tinged easily with hæmatoxylin and aniline colors as eosin and methylviolet.

I would be pleased to receive these root galls on any plants, from any parties who would be kind enough to look for them on any shrubs. The host plant should in all cases be given and the roots well wrapped in peat moss or other damp packing material to keep them fresh.

EXPLANATION OF PLATE CXXVIII.

Fig. 1.—*Frankia Alni* (Wor.), root galls on *Alnus serrulata*.

Fig. 2.—*Frankia Ceanothi*, Atkinson. root galls on *Ceanothus Americanus*.

Fig. 3.—Same, group of parenchymatous cells showing two containing fungus.

Fig. 4—Same, showing cluster of sporangia more highly magnified. The cluster has been removed from the cell.

Phytopathological Laboratory, Alabama Polytechnic Institute,
Auburn, Ala., April 14, 1892.

* Brunchorst, Unters. Bot. Inst. Tubingin. 1886. B. Frank, Bericht. d. Deutsch. Bot. Ges. V. 2.

Impressions of Alaska.

By Grace E. Cooley.

A short trip of five weeks to southeastern Alaska must give only the merest impression of its beauties and resources, yet the mind is crowded full of memories of pleasant days, beautiful pictures and interesting questions about our "new Eldorado." This name has been justly given to Alaska, for its quartz ledges have been "prospected" by the gold-seeker from Fort Tongas to the Yukon, and to him the country is best known—even the Government exploring parties to the interior still following his trail. The rest of the world, held in check by the instant barriers to intrusion presented by the Coast range, skirt the shore and scarcely touch foot a mile from the sea; while the greater mass of travelers who "go to Alaska" sleep, eat and live on the steamer from Puget's Sound to Sitka and back to the starting-point. Hence we gain, at best, only a slight conception of this vast country, with its miles of unexplored mountains and plains, though the imagination is fired and the impression is vivid and lasting.

To the tourist, a trip to Alaska means ocean travel, with all of its delights and none of its disagreeable features. It means two thousand miles of panoramic scenery, as if Norway with its fiords and Switzerland with its glaciers and white peaks could be unrolled as a scroll and viewed from a steamer's deck. There are to be seen dome-like peaks, snow-capped like Ranier and Baker, sharp-pointed and glacier-bearing like Fairweather and Crillon. Here also are inlets and channels, deep and narrow, between high, rocky walls, with the Cascades on the east bathing their feet in the Pacific waters, and the mountain-tops of a submerged range closing the western view.

From Puget's Sound north for a thousand miles to 60°, to where the coast line turns to run directly west, the map shows a long series of passage-ways between a ragged coast and the fringe of out-lying islands, these last being only parts of the mountain-chain that dips into the sea from that lower portion in Washington which we call the Olympics. So deep are some of these passages that no anchorage is afforded, and so narrow that one well-remembered night, being caught by a sudden fog, we steered

by the echo of the ship's whistle from the cliffs on either side. Sometimes, without a foothold of beach, the steep slopes run up one thousand to three thousand feet, clothed to the top with evergreens and musical with waterfalls.

To the geologist this coast presents many interesting features, for forces of ice and water are still active and the mountains are of quite recent formation, so that many of the sharp peaks are still unworn by mountain torrents.

The artist sees gorgeous coloring, almost tropical luxuriance of verdure, beautiful head-lands, wonderful vistas, and has mountain, valley, cascade, and a strange, picturesque people as subjects of study.

The botanist is enough of a poet to share in the feelings of artist, geologist and tourist, though he may not in those of the gold-seeker, and to him it is a new world of tantalizing mysteries.

It comes so close to Kamschatka, that strange land, still wrapped in the weird twilight, through which, as imaginative school-children, we viewed its long, queer peninsula. Anything specifically "Kamschatkensis" would be strange indeed, and no doubt stray waifs from there are lurking in these forest shades or above them on the mountain tops. Perhaps, too, one may get here a glimpse of Japanese or Chinese flowers, for we are told of that Japan current, that tradition says brought the Klingets to these shores.

Furthermore, we are speeding toward the place where flowers have a day of twenty-four hours in which to deepen and strengthen their color and perfume, and Alpine and Arctic plants will always be loved by the botanist. So, while the tourist is enjoying a half-doze over his panorama from the steamer-chair, you are longing for a closer view of the plants that clothe the banks. You are wise, then, if you have taken a freight steamer, that can give you, while doing its own business at the canneries, from four to thirty-six hours on shore every day or two of the three weeks in which the trip is made.

At Loring, fairly down on the Alaskan coast, the shore is typical of what is to be seen for hundreds of miles farther north. A narrow trail runs along a tiny strip of beach to an Indian *rancherie* of a score of houses, all facing the shore and backed

against the rising ground of the mountain-side. Here it is a look straight up into the air to reach the sky-line, and the mountain is heavily wooded with evergreens.

Hemlock is abundant and beautiful, the branches of the *Tsuga Mertensiana* being more graceful than those of our eastern one, having a little the effect of a drooping Norway spruce, though of course the tree is of magnificent size and different proportions.

The Menzies spruce is the most common tree here, and in all the parts of Alaska that I visited, and is said to constitute nine-tenths of the coast forest. It is called the "Sitka Pine," and is cut for lumber in the settlements about Juneau. Its shape is like the fir of our Maine coast, presenting the same slender spires in the profile of an horizon line, but it stands one hundred and fifty or two hundred feet high, and measures six feet or more in diameter. Another evergreen, less common, is *Tsuga excelsa*, the yellow cedar or yellow cypress.

This forest forms the northern part of the most magnificent reach in the world, that which runs through British Columbia to Washington and Oregon, where the trees—influenced by the same conditions of warmth and humidity which operate here, but with shorter winters—reach their grandest proportions.

Taking a trail through the woods, we climb over logs by means of steps cut into the trunks; walk over logs or stumble over loose rocks, always under the cover of thick boughs, draped and festooned with mosses and lichens.

The commonest mosses are golden green *Hypnums*, as *Hypnum loreum* and *triquetrum*, or the pale and matted *H. undulatum;* these, with such lichens as *Sticta Oregana*, *Usnea barbata*, *Alectoria ochroleuca*, vars. *sarmentosa* and *Fremontii*, swathe the branches with thick bands and render them graceful with delicate grey and black draperies. After a rain, when a tardily-setting sun throws its horizontal rays into these dark coverts, they are brilliant with gorgeous coloring.

Our path is stopped at last by a wall of rock, over which tumbles a cascade, half-hidden by the mosses and maidenhair ferns that the rocks carry. A step down from the fallen tree on which we are walking takes us into the deep moss carpet that everywhere covers the ground. Here are *Hypnum splendens*,

Climacium Ruthenicum, Mnium punctatum for the taller forms, and multitudes more. Meanwhile the eye is delighting itself in ferns, herbs and shrubs of all kinds. Here are Aspidiums and Phegopteris disputing with the mosses for foothold; *Maianthemum bifolium*, under var. *dilatatum; Clintonia uniflora*, with its one blue berry; *Cornus Canadensis;* and *Streptopus amplexifolius*, brightening with its half-ripe fruit the deep greens of the background.

And berry-bushes untold! One has said of Alaska, that God must have made this country with special forethought, for his creatures can live here without considering the question of "what shall we eat and what shall we drink,"—the berries, fish and fowl leave man nothing to labor for. We found strawberries, salmonberries, two species of trailing *Rubus, stellatus* and *pedatus;* high blackberries, low blackberries, a raspberry, and four species of gooseberries and currants, all edible; *Sambucus racemosa*, of which the Indians are fond; *Viburnum pauciflorum; Vaccinium Myrtillus* and *ovalifolium;* the red blueberry, *parvifolium;* the Salal, so highly valued; a pleasant small cranberry and *Vaccinium Vitis-Idæa*, almost as good—enough for man and beast—Klinget and bear and duck.

I gathered nineteen of the twenty edible berries which a Chilcat missionary told me are to be found. Of these the salmonberry, gathered in the summer and preserved for winter use in salmon oil, is most valued. It is a large salmon-colored or orange raspberry, very delicious when picked and eaten fresh from the bushes, though disappointing if bought from the Indians on the wharf, where the aroma of oil that pervades everything Klinget clings to them.

Juneau is a mining town, and is the largest in Alaska. It lies about 58° north latitude, and is overhung by a mountain three thousand five hundred feet high; fronts a long range on Douglas Island, while back of the town peak rises beyond peak. Here we made a stop of fifteen days, hospitably entertained by some sweet French sisters of the St. Ann's Mission, who have a school and miners' hospital here. I find an old map has "perpetual rain" written across the country at this place, but fortunately we had as many bright days for collecting as we could use, for so

saturated is the atmosphere that we were forced to resort to the laborious process of stove heat to dry our papers. Very few of our plants moulded, however, due to our care and to the precaution of poisoning our blotters before we left Seattle. Juneau has a reputation for more rain than Chilcat or Sitka, and a botanist friend speaks with enthusiasm of the clear, dry air he experienced in a short trip of thirteen days up the coast.

A delightful excursion from here is up Gold Creek Cañon for four miles and a half to Silver Bow Basin, a high level tract of a mile in width, completely shut in by mountains. In following Gold Creek up through the cañon we make a rise of two thousand feet, and for the whole distance we are charmed with the scenery, for the stream winds in among the mountains in such fashion as to open continually new vistas with other snowy summits. Here are alders and willows, with blackberry bushes for the undergrowth, the *Picea Sitchensis* raising its fair straight trunks above them. Ferns are abundant: *Aspidium spinulosum*, *Polypodium vulgare*, with other old friends, *Adiantum pedatum*, *Cysopteris fragilis* and the Beech ferns, *Phegopteris Dryopteris* and *polypodioides*. *Pteris aquilina* is here too, but is three, four or five feet high, and its downy fronds show it to be the var. *lanuginosa*. All the ferns are tall, but are familiar forms, the *Cryptogramme acrostichoides* being an exception to this rule. This is to be found covering the barren rocks of a landslide or the debris left from the miners' blasts. *Aquilegia formosa*, *Aconitum*, *Campanula*, *Circæa*, *Galium* and *Saxifraga* are found in profusion.

The *Asters* are of the division with narrow linear leaves, dark green in color, the heads being large, deep violet, with loosely imbricated involucres.

Geranium erianthum, the western form of our *maculatum*, differs little from it except in color and texture, but its pure blue blossoms are much more lovely. The *Saxifragas* are omnipresent in many plumy graceful shapes, and the *Streptopus* is another plant always to be met with. Mosses clothe every place left untrimmed with flowers.

Reaching the basin, we come to the largest placer gold-mine in the world, worked by mountain streams brought to bear upon the disintegrated rock by means of immense hydraulic rams, the

water with its charge of gold-dust and gravel being sent through a tunnel three thousand feet long, where quicksilver catches the gold.

Here are sphagnum swamps encircled by alders and willows, and whitened with *Eriophorums* like our bogs at home in New England.

Potentilla palustris, which we find here, is an old friend, too, but the snowy slopes that wall us in remind us that we are in Alaska. These slopes are rich in brilliant flowering plants, particularly alpine and sub-alpine.

As we ascend along the snowy gorge, we meet above the tree-line and the salmonberry bushes a tangle of *Heracleum lanatum*, *Aquilegia formosa*, *Aconitum*, *Veratrum*, *Senecio*, *Valeriana*, *Geranium* and *Spiræa* Then the flowers show broad belts of color: here are the rose purple and white *Epilobium latifolium;* golden *Geums* and *Ranunculus;* blue *Violas;* pink *Pyrola minor;* white *Polygonum viriparum;* white *Eriogynia pectinata* with its beautiful feathery vines; heath like plants, as *Cassiope*, in pink and white; *Bryanthus glandulifiorus*, yellow-green; *Silene acaulis*, showing a rich spread of pink; *Hieracium triste*, with black woolly involucres; *Anemone Richardsoni*, delicate yellow; white *A. narcissiflora*, and *parviflora* veined with purple. There were *Arnicas*, too, and representatives of *Saxifraga*, *Parnassia*, *Tofieldia*, *Gentiana*, *Pedicularis*, *Astragalus*, *Oxytropis*, *Habenaria*, *Stellaria*, and *Cerastium*, alpine *Salices* in full bloom, and many more, covering the steep mountain-side, where the loose rocks would seem to leave no chance for even a plant to find foothold. From the top the slope presents a gorgeous stretch of color long to be remembered!

In going to a new region the relative importance of certain genera hardly noticed at home comes out sharply.

The *Saxifrages* are here a dominating group, both as to abundance and variety.

The *Tiarella trifoliata* is graceful and delicate; *Mitella pentandra* and *Telima grandiflora* are sturdy, rough-leaved plants; *Boykinia major* is a plumy species, and covers the rocks with its white sprays. Over the bare landslides spread *Saxifraga leucanthemifolia* and *S. punctata;* and *S. bronchialis*, and *S oppo-*

sitifolia creep over other barren places, the latter a most curious plant with sharply ciliated leaves, which are curiously punctured at the top, as if with a conductor's punch.

Even the Hydrophyllaceous plant *Romanzoffia Sitchensis* takes on the characters of the *Saxifrages* so that it deceived the very elect, and was at first put in the family with them.

Up and down the shore from Juneau are cañons, cut by the cold mountain streams, and to these we went for botanical specimens, learning to know the ill-traits of that pest of the prospector, the Devil's Club.

Climbing over a slippery tree-trunk covered with moss is not an easy task, and there stands always at hand this instrument of Satan, which you instinctively grasp to your sorrow, for the spines find means to punish you. You slip, perhaps, off this same log that is helping you over a bog of deep, moist mosses, and the declined stem of the plant sinks with you and acts as a lever to hit you in the face with the thickened end of the stem. It deserves its grotesque name of *Fatsia horrida*, yet it adds much to the beauty of the forest, with its thick, vine-like foliage, particularly in the fall, when, I am told, the leaves take on a soft yet brilliant orange-yellow color, giving to the otherwise sombre, evergreen shades an autumnal richness.

At Salmon Creek, where we saw the beautiful fish for which it is named, attempt to scale the fall of fifteen feet, we found the Siberian Lily, rich orange with dark brown markings; had our first experience of exploring a forest with no trail, and found the *Mertensia maritima* on the beach, that four years ago I found at Mt. Desert, Me. *Lysichiton Kamschatkensis* takes the place of our *Symplocarpus fœtidus* in the swamp; and *Mimulus luteus, Claytonia Sibirica, Epilobium luteum* and *Impatiens fulva* border the brooks, which are too cold to support life themselves, being glacier or snow-fed all summer.

South of Juneau, Sheep Creek leads up a rocky gorge, choked with the brilliant greens of the mosses, to the upper pastures where the mountain sheep feed; here we found bears' tracks in the salmonberry bushes, and rejoiced in the sight of blue glaciers in the mountains. Here were *Coptis asplenifolia* and *Trientalis Europæa* and long reaches of scarlet *Castilleia*. I found

more Cottonwoods and *Viburnums* in the cañon than I found elsewhere, and the mosses and lichens would have repaid several days of botanizing.

In looking over the records I find that the Alaska botanizing has been chiefly done at Sitka and Unalaschka, a few collections having been made on the Yukon. There is much rich material awaiting the systematic collector, and the wholly unexplored eastern slope of the Cascades will surely bring new species to light.

Macoun, in his "Catalogue of Canadian Plants," has indicated the results of the earlier and later botanists, and a glance at that list will show how much ground has yet to be explored.

Chilcat, at the entrance to the pass to the Yukon, is a level stretch between two mountain ridges lying at the northern extremity of the coast, where the turn westward is made. It must be rich in flowering plants, and the configuration of the land must make it a particularly interesting field for the botanist. A stop of thirty-six hours tempted us to remain for further exploration, but that was impossible. However, we visited an almost unexplored glacier (the Davidson), doing what no tourists had ever done before us, we were told. The glacier is a large one, but is slowly dying, the foot of it, which once pushed out into the sea, being now fronted by a terminal moraine from one to three miles broad. This is densely covered with vegetation, and would well repay a botanist's study.

Problems which confront a botanist in visiting a region new to him relate to the history of the flora spread out before him, its relation to the floras with which he is familiar, and the causes of difference. These questions find answer in the climatic influences of the present and those which have operated in the past; with, as well, the geologic history of the region, including great catastrophes, such as mountain building, subsidence or changes in climate due to ocean currents, or those vaster ones which produced a glacial period.

At present the climate of the southeastern coast of Alaska is mild and moist, being like that of Oregon and Washington, modified by the higher latitude, which brings with it long winters, when the moisture in the air, always abundant, falls in snow instead of rain, as farther south. These immense snow-fields, being

too large for the short summers even with their Arctic heat to melt, temper the otherwise unmitigated intensity of a sun that shines for the greater part of the twenty-four hours.

The isotherm of 45° passing through Sitka is the same as that of Montreal. The January mean temperature of 1888 was 30.2°, and August of the same year 58.4°, the thermometer rising to 89° and 90° on the hottest days. This mildness and moisture comes from the prevailing winds which blow in-shore from the warm equatorial current, that turns across the ocean from Japan and then sweeps down the coast, giving California its delightful climate and making the most magnificent forest belt in the world. The trees are few in species, mostly conifers, with a sprinkling of cottonwoods, but they are densely crowded and grand in height and diameter, their coverts luxuriating in mosses and lichens.

The long winter, with its abundant congelation, and the short summer, effect a snow-line which is comparatively low at Juneau, 58° north, being about 3,500 feet. This produces a crowding of the plants, alpine and sub-alpine, low down upon the mountains, particularly where the glaciers descend to the sea.

In a climb of three thousand feet one passes species found in California, Washington, New England, Greenland and Labrador, or finds the same species in fruit, flower and bud. Looking over the plants of my collection, I note that they fall into four classes according to distribution.

First, those confined to the range of the forest belt; *i. e.*, from the Aleutian Islands to California, climbing the mountains as they descend; such are:

Gentiana Douglasiana, Bong.
Vaccinium parvifolium, Smith.
Romanzoffia Sitchensis, Bong.

Second, those which follow the mountain ranges southward, and extend eastward to the Rocky Mountains:

Bryanthus glanduliflorus, Gray.
Castilleia miniata, Dougl.
Mimulus luteus, Linn.

Third, those plants whose range is eastward to New England, and westward to Japan or Siberia:

Cornus Canadensis, Linn.

Heracleum lanatum, Michx.
Veratrum viride, Ait.
Streptopus roseus, Michx.

Fourth, those cosmopolitans of the Arctic circle or alpine plants which find a home in Greenland, Arctic America, Europe and Asia:

Pedicularis Langsdorffii, Fisch.
Ranunculus pygmæus, Wahl.

This classification marks, perhaps, degrees of vigor in withstanding climatic influences, the last group being the hardiest in constitution, the first being most affected by disturbing influences, and so occupying only the narrow belt which was most conducive to their well-being. I like to think of Alaska as being near the home land of the present earth's flora, within that circle of distribution around the pole, whose radius met the circumference in Greenland on the one hand and Europe on the other; when, in the tertiary period, the temperate floras stood together north of the Arctic circle.

The mind surveys the change that drove before the advancing glaciers the present Arctic plants down to the latitude of the Ohio, and sees again the return of the exiles north toward their trysting-place, until we find the best travelers close up to the Arctic circle, uniform or nearly so around the pole, while lower down the weaker brethren remain in widely different belts, or perhaps are slowly traveling still, though far in the rear. In the first group we find distinctively western forms of not so close relationship to those of Asia as are the eastern American, due probably to the fact of the great elevation and longer glaciation of the west coast.

Here in Alaska we have mountains which seem not to have been free of ice since the glacial period; so here we appear to stand on the borders of the retiring ice age, and survey from this vantage ground the present world-flora and the mysteries of its past history.

Scores of questions which sought to penetrate that mysterious past crowded the mind on that wonderful day when we invaded the ice-fields themselves and steamed fearlessly up Glacier Bay among the threatening icebergs, and anchored under the mile-

wide façade of the great Muir glacier, lifting its blue wall of ice two hundred feet above the bay. Here we were in the very workshop of Nature, and world-building was in active process with the wonderful implement that the glacier has proved to be still working its will upon the plastic earth.

Glacier Bay is thirty miles long, and hundreds of acres of ice from a dozen glaciers are pushing relentlessly down to the sea from such peaks as Crillon and Fairweather, that tower in majestic whiteness fifteen thousand and sixteen thousand feet above us.

It is a weird and magnificent scene! The bare, brown shores are scoured and scored with recent ice; the blue bay floats icebergs of curious forms, all rich in coloring, pure white, deep blue or green, or shaded and toned with debris, while over beyond the peaks of the Fairweather range stand shoulder to shoulder in quiet, calm majesty.

What is this activity we see before us? What is Nature about? Have we indeed tracked the glacial period to this point in its retreat from the South, or have these mountains arisen since then? It is a retreat, surely, for high above our heads, two thousand feet up the mountain side, we see the footprints of former ice-fields, while the flowers, *Epilobiums* and Gentians, are waving their gay pennons of triumphant advance wherever the moraine gives them vantage ground. Is not this the place to study the floral repeopling of the Northern areas?

Dr. Russell, in his account of the expedition to Mt. St. Elias, speaks of Blossom Island, surrounded by perpetual snow, yet producing spruces, ferns, hellebore, gentians, orchids and berry-bushes. Who will tell us how these adventurers came there? What means of dissemination or strength of constitution have they that gives them the advantage?

Another question meets us: if, indeed, our temperate floras are on the march, in what order have the exiled plants followed the glaciers? Is it mere hardiness of constitution or better means of dissemination that bring the birch and alder close up to the Northern tree-line? Is the oak as sure to follow, but by easier stages, as befits its dignity?

We have been too prone to consider our present floras as fixed, but are there not many indications of change under our

eyes to-day? Dr. Gray and Dr. Hooker have left many problems of distribution for us younger ones to puzzle over.

A look to the future shows us that many fossil treasures are in this retreat of the ice slowly coming to light again. To those already found we owe much that we know of the history of the tertiary period, but that history will surely be rendered more vivid if a few generations of note-taking botanists study on their own ground the rapidity with which vegetation follows the retreating glaciers, and learn the order of its march.

Alaska will give us object lessons, if we will but heed them, and no more interesting or accessible field presents itself to American botanists.

Leucobryum minus, Hampe.

Through the kindness of Mr. Carruthers and Mr. Gepp of the British Natural History Museum, I have been able to see the type of this species, which has been variously confounded with *L. albidum* (Brid) Lindb. by European authors, including Braithwaite in his supplement to the British Moss-Flora, p. 295, and Limpricht in Rabenhorst's Kryptogamen Flora, iv., 421. Authentic specimens, compared with the type, were sent to Dr. Braithwaite, and he admitts that all the synonymy on page 296 l. c., except the last line, should be omitted. Mr. Kern also kindly sent a specimen of his Lago Maggiore collection, mentioned by Limpricht, l. c., and this also proves to be not our *L. minus*, Hampe, but the species known as *L. albidum* (Brid.) Lindb. Hampe's specimen was collected in "lignis putridis, ad flume Savannah, Ga.," by Beyrich, and is the characteristic moss of our Southern States, distributed by Sullivant in his Musci Alleghaniensis, No. 169, as *Dicranum glaucum*, var. *albidum*, Brid. from Georgia, Alabama, and Louisiana; also by Austin in his Musci Appalachiani, 477, as "*L. vulgare*, var. *minus*, (*L. minus*, Hampe) from the Southern States, common;" but the reference to Sullivant Mosses U. S., page 24, is wrong, as Sullivant referred to the smaller of the Northern States species, which has been separated from *L. glaucum* (L.), and which is identical with the European specimens described by Braithwaite and Limpricht. Sullivant and Lesquereux are partly responsible

for some of the confusion into which we have fallen, for No. 98 Musci Bor. Am. is a mixed specimen, distributed as "*L. minus*, Hpe. Hab. in Ohio," but containing both *L. minus* and *L. albidum*. The specimens from Lancaster, Ohio, in Sullivant's own herbarium, however, are all the northern species agreeing with European specimens, and not *L. minus*, Hpe. Further confusion has been caused by Lesquereux and James' Manual, page 91, where *L. minus*, Hampe, is cited as a synonymn of *L. minus*, Sulliv., which it is not, and the true *L. minus*, Hpe. is described as *L. sediforme*, Mueller. Again authentic specimens were sent to Dr. Carl Mueller and he says "*Leucobryum minus*, Hpe. tuum non est meam *L. sediforme*, Syn. Musc. differentiam inter speciem utramque perfecte descripsit. Huosque tantam insula Hispaniola accepi." That is, *L. sediforme* is not our Florida species.

Authentic specimens from Florida were also sent to William Mitten, who says in part "I have Drummond's 46, *D. glaucum* var. *albidum*, from New Orleans, and a small specimen from James, marked by him '*L. sediforme?* Florida, Palmer,' and another small specimen from Florida collected by LeConte. All these have the short, wide, appressed foliage so evident in your specimen. I have also a scrap of Sullivant No. 77 *L. minus*, Hpe., Ohio, with longer, narrower, more spreading leaves." Acting on Dr. Mitten's suggestion I sent to Paris authentic specimens of *L. minus*, Hpe. in this case a portion of Austin's Musci Appalachiani, No. 477, for comparison with Michaux's type of *D. glaucum pumilum*, at the Jardin des Plantes. M. Franchet kindly sent me a fruiting plant, and Mr. A. F. Foerste made a series of measurements for me, which prove Michaux's specimens to be the same species as Hampe's *L. minus*.

Michaux in his Flora Bor. Am. ii. p. 297 (1803) says: "Dicranum glaucum: *pumilum*. D. caulibus ramosis, densissima foliatione crassis, foliis glaucis, convexo-canaliculatis. sporangio subinclinato, oblongo-ovato; operculo gracilter subulato, subinflexo. Obs. Mea varietas humillima, foliis acuminatis. Hab. in Carolina." Now in view of the confused state of the name *L. minus*, both in America and in Europe, would it not be well to adopt Michaux's prior name for the plant of the Southern United States, and call it *L. pumilum* (Michx.), 1803, (*L.*

minus, Hpe.), 1839; and Bridel's name for the specimens from Ohio and the Northern United States (*L. minus*, Sull.), and call them *L. albidum* (Brid.) Lindb.? In order to be certain that Bridel's *D. albidum* is the same as the Ohio specimens in Sullivant's herbarium, I have asked Dr. W. G. Farlow to make the comparison for me at Berlin, and he has kindly consented to, and taken a portion of Sullivant's specimens for that purpose. I have not yet heard from him, but meanwhile this much is certain, that *L. minus*, Sulliv. of Lesquereux and James' Manual, p. 91, is not the same as *L. minus*, Hpe., and that the description of *L. sediforme* of the Manual is meant for specimens of the same Hampe's *L. minus*. What the European specimens shall be called, however, had better be determined by some one who has more ready access to the types than I. M. Bescherelle, to whom M. Franchet also referred the question, says, "J'ai etudie le Bryum glaucum minus forma pumilum de Michaux, et je n'y vois aucune difference avec le *Dicranum albidum*, Brid." But I doubt the correctness of this statement unless he has seen Bridel's type, for Bridel in his Bryologia Universalis i. 409, 1826, cites the following localities for *D. glaucum*, var. *albidum*, "Pennsylvania, Virginia, et Massachusetts unde D. Torrey misit." One of these specimens is preserved in the Torrey Herbarium, labelled "Dicranum albidum, No. 14, legit Schweinitz, Pennsylvania," and is identical with Sullivant's specimens from Ohio, having the leaves longer than *L. minus*, Hpe., apex more acuminate, hyaline border of the base narrower. The difference in the aspect of the two also is very marked, *L. minus*, Hpe. being shorter, denser, with more crowded leaves, which are more closely imbricated and erect, with incurved cucullate apex. The range also is different, *L. minus*, Hpe. not having been collected thus far north of Carolina, while *L. minus*, Sull. occurs throughout the Northern States, also running south into Louisiana.

I shall be pleased to receive and examine specimens of *Leucobryum* from any and all collectors.

ELIZABETH G. BRITTON.

The Flora of a Montana Pond.

R. S. Williams.

A few miles from Great Falls, near the middle of a low flat extending out from the valley of Sand Coulee, is a slight circular depression in the clayey soil, perhaps two hundred yards across. In rainy seasons this is filled with water to a depth of three or four feet in the center, gradually diminishing in depth toward the edges. It is entirely without springs and has no particular inlet or outlet. Last season, after having been dry and almost without sign of vegetable life for a year or more, it was filled with water, and the following notes relate to the abundant vegetation that sprang up from a seemingly lifeless clay-bed. Reference also will be made to the plants observed on the surrounding prairie, within a distance of a few hundred yards of the water, but the observations, relating to the latter part of August, do not include, of course, many noticeable species of the spring and early summer.

The most abundant grass of the vicinity was *Agropyrum glaucum*, of a growth sufficient to make an excellent hay crop. Mingled with this, and occasionally the more abundant of the two, was found *Alopecurus Californicus*. This is a western species, and was determined by Dr. Vasey, who remarked that he had not before received it from any point so far to the eastward. Dead culms of this *Alopecurus* that had matured seed in June were standing on the same plants beside the still green, but ripening culms of a second growth. *Bouteloua oligostachya* was common as elsewhere, often being the principal grass on any slight knoll or hillside. The only other grass observed was *Schedonnardus Texanus*. It occurred mostly in separate areas in rather compact patches a foot or so across, and although growth had ceased for some time it was perhaps more noticeable than earlier, owing to the dry, whitish appearance of the slender, curved culms that stood out in all directions in an intricate network.

Mingled with these grasses were a few composites in bloom, the most conspicuous being *Grindelia squarrosa*, *Aster commutatus* and *Helianthus annuus*. *Gutierrezia Euthamiæ*, growing almost everywhere, was scarcely yet in flower, not being in full

bloom till September, or even October. One more plant of this family, and perhaps the most curious and interesting of them all, was *Evax prolifera*, growing in low places where the grass was thin or altogether wanting. In many respects it resembles the Edelweis of the Alps, although its home and surroundings are so exceedingly humble as compared with that celebrated plant. Dead specimens of the *Evax* were very numerous in places, and resembled, more than anything else, small, blackish tufts of upturned fiberous roots. The stems and branches of the growing plants, indeed, are stiff and wiry, and would hardly be noticed were it not for the curious heads of woolly flowers they bear.

In about the same situations as the above, *Herpestis rotundifolia* was found abundantly both in flower and fruit. The range of this is given in the last edition of Gray's Manual as "Illinois to Minnesota, Missouri and southward," but in the Synoptical Flora of North America it is referred to as growing out of ordinary range in Fresno Co., California, and it evidently may prove to be more of a western plant than has heretofore been supposed. The corollas of the plants in the present case were perfectly white, with lobes just about equal and stamens of equal length. I called the attention of Prof. Eaton to these points, and he writes that he has evidently the same plant from Illinois, collected by Lesquereux, who notes, "corolla white, almost equally five-cleft." Possibly the normal color of the flower is white, although the botanies till recently have mostly given it as blue.

Other plants growing about the pond were *Limosella aquatica*, very abundant and often submerged in the water, *Rumex salicifolius*, *Verbena bracteosa*, *Œnothera triloba*, a common but inconspicuous species, *Krynitzkia Californica*, *Boisduvallia glabella*, abundant along the very edge of the pond, and *Gilia intertexta*, of which only a specimen or two was observed. These last two mentioned species are well-known western plants that here in Montana, at least, cross to the eastern slope of the Rocky Mountains.

The above about completes the list of species noted around the margin of the pond, and it will be observed does not include a shrub or tree of any kind. Doubtless rose bushes of stunted growth existed, but were overlooked at this season.

In the water the most conspicuous plant was *Eleocharis palustris* rising to a height of one or two feet above the surface, and affording shelter to a flock of some forty or fifty wild ducks. *E. acicularis* was the only other sedge noticed, and grew perhaps more along the edge of the pond than in the water. *Alisma Plantago* and *Sagittaria variabilis* were both common. *Potamogeton hybridus*, not before noted in Montana, filled the water in places with a tangled mass, while a single plant of *Naias flexilis* was found near the shore, but a somewhat prolonged search failed to reveal a second specimen. Two species of *Elatine* were abundant. *E. Americana* growing both on the muddy banks and submerged in the pond, and *E. Californica*, a western plant, only found submerged. This last has pedicelled flowers and much curved seeds. A few blossoms of *Utricularia vulgaris* rose out of the water, but the plants, which were common enough, were mostly not yet in bloom; also a few plants of the *Herpestis* above mentioned were found in several inches of water with leaves mostly floating and flowers emergent. The only other aquatic flowering plant recorded was *Callitriche verna*, growing very abundautly in some of the shallower places.

A single moss was found mingled with the aquatic plants It was evidently a sterile, lax form of *Hypnum fluitans*, and was not common.

The three remaining plants collected at this time belonged to the Characeæ and were submitted to Dr. T. F. Allen. He writes that they are of much interest, the species being *Nitella clavata*, *N. opaca* and *Chara Altaica*, this last not before credited to North America, and originally coming from the Altai Mountains of Asia. The species were all quite abundant, and bore well-developed fruit. They were mostly growing near the margin of the pond in two or three inches of water, and were quite strongly attached to the mud of the bottom.

In closing I would make grateful acknowledgment to Prof. D. C. Eaton for assistance in determining all the more difficult species when not otherwise stated.

Great Falls, Mont.

Botanical Notes.

Sphagna from North Carolina. Since the list of North Carolina mosses was published, in the MEMOIRS, vol. iii. p. 37, a report on the *Sphagna* has been received from C. Warnstorf, and some corrections are necessary: *Sphagnum cymbifolium*=*S. imbricatum*, Hornsch, var., *cristatum*, Warnst. The unnamed *Sphagnum*=*S. imbricatum*, Hornsch, var., *sublæve*, Warnst. and *S. rigidum*=(when placed under the older name) *S. compactum*, var. *imbricatum*, Warnst.

J. K. SMALL.

The Host-Plant of Aphyllon Ludovicianum. In connection with Mr. Hill's article on page 17 of the BULLETIN for January, I would like to report that *Aphyllon Ludovicianum* is found here sparingly; on two occasions I have found it growing on roots of *Ambrosia trifida*, as a parasite.

JACOB SCHNECK.

Index to Recent Literature Relating to American Botany.

About Lichens. F. Leroy Sargent. (Popular Sci. News, xxvi. 50, 65-67, illustrated).

Almond Trees—A Disease of. Newton B. Pierce. (Journ. Mycol. vii. 66, illustrated).

American Hawthorns—The. (Gard. & For. v. 217), with an illustration of *Cratægus mollis* in New England.

Botany of the Zoological Park. W. Hunter, L. F. Ward and W. H. Knowlton. (Smithsonian Rept. 1890, 68-72).

This is a list of some 350 species and varieties, including the Pteridophyta, identified within the limits of the National Zoological Park, D. C. Accompanying the general report upon the Park there is also a separate list of the forest trees, in which forty-six species are enumerated (pp. 65, 66).

Cercospora circumscissa—Suggestions in regard to the Treatment of. B. T. Galloway. (Journ. Mycol. vii. 77).

Chilian Pine—The. (The Garden xli. 32). With illustration of *Araucaria imbricata.*

Club-Root in the United States. A. C. Eycleshymer. (Journ. Mycol. vii. 79). With illustrations of *Plasmodiophora brassicæ*, Wor.

Coontie and Conte. E. J. Hill. (Gard. & For. v. 208).

An interesting note on the identity of Coontie or Wild Sago of the Seminole Indians with *Zamia integrifolia*, Willd. Owing to the similarity of the common names of the two plants it has been confounded with *Smilax Pseudo-China.*

Dendrophthora cupressoides. (Hooker Icon. Pl. t. 222 1).

Descriptions of new Plants from Southern California, Nevada, Utah and Arizona. F. V. Coville. (Proc. Biol. Soc. Washington, vii. 65-80; reprints).

These were mainly obtained by Mr. Coville himself, while botanist of the Death Valley biological expedition of last year. *Aplopappus interior, Arctomecon Merriami, Arctomecon humile, Arenaria compacta, Brickellia desertorum, Buddleia Utahensis, Erigeron calva, Erysimum asperum perenne*, Watson, *Frasera tubulosa, Gilia setosissima punctata, Isomeris arborea globosa, Lepidospartum striatum, Mentzelia reflexa, Phacelia perityloides, Potentilla eremica, P. purpurascens pinetorum, Sarcobatus Baileyi, Saxifraga integrifolia sierræ, Stylocline Arizonica* are described as new.

Desmodium nudiflorum. (Meehan's Month. ii. 65, with illustration).

Doassansia, Cornu—An Examination of the Species of the Genus. William Albert Setchell. (Ann. Bot. vi. 2; with plates i and ii).

The new species described are *Doassansia opaca, D. obscura. D. deformans.* Two new genera—*Cornuella* and *Burrillia*—are established, each with one species.

Evolution of Bubbles of Gas by Plants in Water exposed to Light, as a Measure of Assimilation—The. A. F. Woods. (Publ. Nebraska Acad. Sci. ii. 13; abstract).

Ferns of the Black Hills. Chas. E. Bessey. (Am. Nat. xxvi. 252).

Field Notes, 1891. Erwin F. Smith. (Journ. Mycol. vii. 88).

A record of observations on the various fungous diseases of fruit trees.

Flora Franciscana. Part III. Edward L. Greene. (pp. 281-342; issued April 1st, 1892).

The following species are described as new: *Eschscholtzia ambigua; Ranunculus alismellus* (*R. alismæfolius*, var. *alismellus*,

A. Gray); *Delphinium ornatum; Thalictrum cæsium; Sambucus callicarpa* (*S. racemosa*, A. Gray, Bot. Cal., not L.); *Meconella Californica* is referred to the genus *Platystemon* as *P. Torreyi; Ranunculus Nelsoni*, A. Gray, is maintained as a species. Sarmentosæ is the ordinal name adopted for the grapes, dating from L. Gerard (1761), Ampelideæ, H.B.K. being published in 1815; *Osmorrhiza*, Raf. is included in *Myrrhis; Razoumofskya*, Hoffm. is accepted for *Arceuthobium*, following O. Kuntze; *Obolaria*, Siegesbeck, replaces *Linnæa*, Gronov., but Siegesbeck's name dates from 1736, a year before Linnæus' Genera Plantarum, and *Caprifolium* another pre-Linnæan name replaces *Lonicera*.

Flora of Nebraska—Additions to the. G. D. Swezey. (Publ. Nebraska Acad. ci. ii. 16; abstract).

Flora of the Artesian Well—Notes on the. J. R. Schofield. (Publ. Nebraska Acad. Sci. ii. 23; abstract).

Flora of the Black Hills—Notes on the. Chas. E. Bessey. (Publ. Nebraska Acad. Sci. ii. 17; abstract).

Flora of Western South Dakota—Notes on the. T. A. Williams. (Am. Nat. xxvi. 60; 253).

Flowers and Insects, Asclepiadaceæ to Scrophulariaceæ. Ch. Robertson. (Trans. Acad. St. Louis v. 569).

Flowers and Insects, Umbelliferæ. Charles Robertson. (Trans. Acad. St. Louis v. 449).

Forests of Lower California—The. C. R. Orcutt. (Gard. and For. v. 183).

Notes on *Pinus Parryana*, *P. monophylla*, *P. Jeffreyi*, var. *peninsularis*, with illustration of the latter, and of a view of a pine forest in Lower California.

Fossil Plants from the Wichita or Permian Beds of Texas. I. C. White. (Bull. Geol. Soc. Am. iii. 217, 218).

By the determination of these species the author has been able to correlate the Texan beds with those of the Dunkard Creek series of Pennsylvania, West Virginia and Ohio. Some twenty species are listed, in the genera *Sphenophyllum*, *Annularia*, *Odontopteris*, *Callipteris*, *Callipteridium*, *Pecopteris*, *Goniopteris*, *Lepidodendron*, and *Walchia*.

Fungi—New Species of. J. B. Ellis and B. M. Everhart. (Journ. Mycol. vii. 130).

Puccinia Suksdorfii, Stictis compressa, Tryblidiella pygmæa, Valsaria hypoxyloides, Phyllosticta gelsemii, Phyllosticta rhododendri, Sphæropsis albescens, Stegonospora spinaciæ, Septoria elymi, S. Jackmani, S. saccharina, S. Drummondii, Hendersonia geographica, Glœosporium catalpæ, G. decolorans, Melanconium magnoliæ, Pestalozzia lateripes, Scolecotrictrum caricæ, Macrosporium tabacinum, M. longipes, Brachysporium Canadense and *Clasterosporium populi.*

Fungous Diseases of Iowa—New. L. H. Pammel. (Jour. Mycol. vii. 95).

Fungus of a Potato Scab—Remarks on the. G. de Lagerheim. (Journ. Mycol. vii. 103).

Ginseng—Notes on. (Am. Nat. xxvi. 343).

Hand-Book of West-American Cone-Bearers. J. G. Lemmon. (Pamph. pp. 24, 2d Edition, Oakland, Cal. 1892).

This, in the language of the author, consists of "approved English names, with brief popular descriptions of the cone bearing trees of the Pacific Slope, north of Mexico and west of the Rocky Mountains." It will prove a useful paper for all who are interested in these wonderful forests, and may be obtained from him at 25 cents per copy.

Hepaticæ of the Hawaiian Islands. A. W. Evans. (Trans. Conn. Acad. viii. pp. 9, reprinted, plates xxii. xxiii).

This enumeration is based on the collections made by D. D. Baldwin in 1875–'76, in the herbarium of Prof. D. C. Eaton, portions of which were examined and named by C. F. Austin. Nine new species are described in the following genera: *Porella, Bazzania, Plagiochila, Jungermannia, Nardia* and *Tylimanthus.*

Myriostoma coliforme, Dicks. in Florida. A. P. Morgan. (Am. Nat. xxvi. 341).

Nebraska—Preliminary Report on the Native Trees and Shrubs of. C. E. Bessey. (Bull. Agric. Exp. Sta. Nebraska iv. Article 4).

Nebraska—Second Report upon the Native Trees and Shrubs of. C. E. Bessey. (Ann. Rep. Nebr. State Hort. Soc. 1892; reprint).

Nebraska—Sixth Annual Report of the Botanist to the State Board of Agriculture. C. E. Bessey. (Ann. Rep. Nebr. State Board Agric. 1892; reprint).

This is a preliminary list of the grasses of Nebraska, with notes on their distribution throughout the State.

Northern Limit of Sabal Palmetto. W. F. Massey. (Gard. & For. v. 189).

Notes on the Flora of Cap-à-L'Aigle— Supplemental. Robert Campbell. (Canad. Rec. Sci. v. 38).

Osmunda Claytoniana, L., and *O. cinnamomea*, L.—*On the Prothallium and Embryo of.* Douglas Houghton Campbell. (Ann. Bot. vi. 49, with four plates).

Peronospora—Description of Two New Species of. M. B. Waite. (Journ. Mycol. vii. 105).

Peronospora celtidis on *Celtis occidentalis*, and *Peronospora hydrophylli* on *Hydrophyllum Virginicum* are described and figured.

Peronosporaceæ in the Herbarium of the Division of Vegetable Pathology. W. T. Swingle. (Journ. Mycol. vii. 109).

Phenomena and Development of Fecundation. H. J. Webber. (Am. Nat. xxvi. 111, 287, with plates.

Pithecolobium Saman. (Gardn. Chron. xi. 256, illustrated).

Primitiæ Floræ Costaricensis. Th. Durand and H. Pittier. (Bull. Soc. Bot. Belg. xxx. 7-97).

This is the first instalment of an account of the Flora of Costa Rica, and contains an introduction, giving notes on the collections hitherto made in that country, and of those recently obtained by M. Pittier. This is followed by an enumeration of the Lichens by Dr. J. Mueller, including 214 species, of which a large number are described as new.

Pyrenomycetes—The North American. J. B. Ellis and B. M. Everhart. (8vo, pp. 800, 41 plates, 1892).

This extensive contribution to mycological botany is welcomed by every lover of fungi, and particularly by those who are engaged in a critical study of the groups covered by this new manual.

Thorough work in the Pyrenomycetes has been long retarded from a lack of accessible full and clear descriptions of the species, the student needing to rely upon a scattered literature and at last resorting to type specimens, many of which are imperfect or entirely lost. The system of classification followed by the

authors has been that of Winter in Kryptogamen Flora (Die Pilze), while Saccardo's principles of arrangement have frequent recognition. Priority of authorship is maintained by the use of parenthesis in all cases when a generical transfer has been made, and none but the author is recognized. In the preface the authors say: "The piratical practice of omitting the first name and substituting the second in its place cannot be too strongly condemned."

Some sub-orders open with a key to the genera, and the wish naturally arises that all groups had been thus prefaced. A key to the sub-orders would also have been welcomed. There is a full index of species, but no corresponding list of the hosts. The forty-one page plates are from drawings by the late F. W. Anderson, who worked from living specimens and presented the salient characters of many of the genera, thus adding greatly to the value of the work. Dr. T. J. Burrill elaborated the Erysipheæ with his usual care.

The work stands as a monument of painstaking effort, upon the part of the authors, to place within the reach of American mycologists a guide to the study of an important and difficult family of fungi. B. D. H.

Sereno Watson. W. H. B. (Am. Journ. Sci. xliii. 441; reprint).

Slime Moulds (Myxomycetes) of Crete. A. T. Bell. (Publ. Nebraska Acad. Sci. ii. 15; abstract).

Spraying for the Prevention of Plant Diseases. Jos. F. James. (Sci. Am. Suppl. xxxiii. 136).

Suggestions on the Classification of Metaphyta. Conway MacMillan. (Bot. Gaz. xvii. 108).

Two Schools of Plant Physiology as at Present Existing in Germany and England. Emily L. Gregory. (Am. Nat. xxvi. pp. 211-217, 279-286).

Vascular Cryptogamia of the Island of Grenada—On the. J. G. Baker. (Ann. Bot. vi. 95).

Acrostichum Sherringii is described as new.

Yuyucha, La. M. G. Lagerheim. (La Notarisia vii. 1376).

A note on *Nostoc commune*, Vauch., an edible alga from Ecuador.

Proceedings of the Club.

WEDNESDAY EVENING, MARCH 30TH.*

The President in the Chair and twenty-three persons present.

The President appointed the following members of the Field Committee for 1892: Mr. Henry Kræmer, Rev. Geo. D. Hulst, Dr. L. Schœney, Miss L. R. Heller, and Mrs. H. L. Smith.

Dr. Morong and Dr. Rusby were appointed delegates to the Council of the Scientific Alliance for the year 1892-'3.

The following were elected active members: Miss H. E. Powers, Baldwins, Long Island; Mr. Geo. V. Nash, Clifton, N. J.; and Dr. H. S. Pepoon, Lewiston, Ill.

The following were elected corresponding members: Rev. C. H. Demetrio, Emma, Saline Co., Mo.; Rev. A. B. Langlois, St. Martinville, La.

Dr. Rusby read the announced paper of the evening on "A Preliminary Account of the Plants collected by Mr. Miguel Bang in Bolivia, with a Description of the floral features of that region." The paper was profusely illustrated by herbarium specimens.

WEDNESDAY EVENING, APRIL 27TH.

Dr. Britton in the Chair, and twenty-seven persons present.

Miss M. Parke, Dr. Donald Barstow and Mr. Frank O. Payne were elected active members.

The chairman exhibited specimens of *Clintonia umbellata*, collected by Mrs. W. H. H. Beebe near Short Hills, N. J. This discovery adds a new plant to the New Jersey Flora and to the Flora of the 100 mile circle, the nearest hitherto reported station for the species being in the Alleghenies of Pennsylvania. Dr. Britton also showed two curious hard black seeds, reported as coming from the coast of California, where they are said to be worn as watch-charms. He had been unable to refer these satisfactorily, but they closely resemble the figure of *Calvaria hexangularis* in Gærtn. Fruct. and Sem. iii. 117, t. CCI. This genus is known only by its seeds.

Dr. Smith Ely Jelliffe gave the announced paper of the evening on "Lichens: an account of the more common species," illustrated by lantern views and herbarium specimens.

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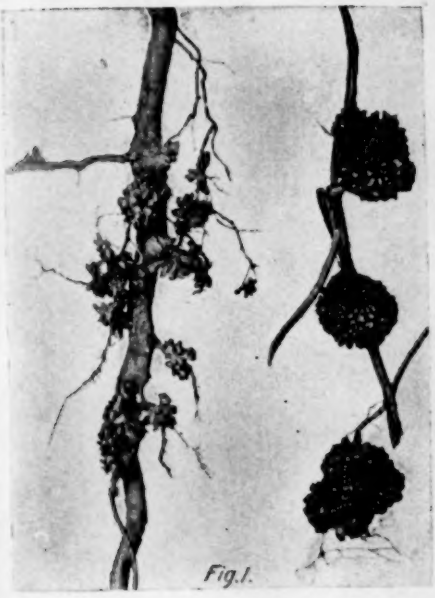
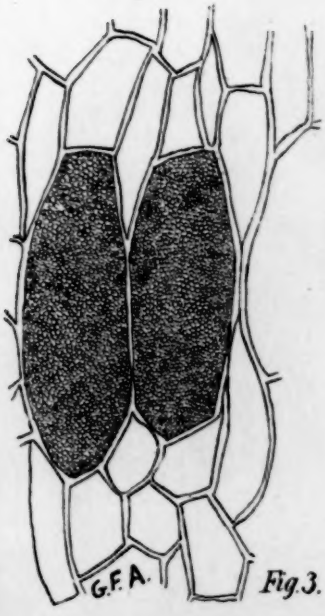
* Accidentally omitted from the last BULLETIN.





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